

WHAT IS CLAIMED IS:

1 1. A head driving apparatus, incorporated in an ink jet printer which
2 comprises:

3 a print head, provided with a plurality of nozzles;

4 piezoelectric elements, each associated with one of the nozzles and
5 provided with a drive electrode and a common electrode; and

6 a head driver, which generates a drive signal for driving the piezoelectric
7 elements, and selectively supplies the drive signal to at least one of the
8 piezoelectric elements to eject an ink droplet from at least one associated
9 nozzle, the head driving apparatus comprising:

10 a bias power source, which applies a bias voltage having a
11 predetermined potential to the common electrode of each piezoelectric
12 element.

1 2. The head driving apparatus as set forth in claim 1, wherein the
2 potential of the bias voltage is variable.

1 3. The head driving apparatus as set forth in claim 1, wherein the bias
2 power source is provided as a logic power source.

1 4. The head driving apparatus as set forth in claim 1, wherein the bias
2 power source generates the bias voltage based on a power supplied from a
3 power source for driving the print head.

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1 5. The head driving apparatus as set forth in claim 4, wherein the bias
2 power source includes:

3 a condenser, electrically connected to the common electrode; and

4 a constant-voltage circuit, which applies the bias voltage to the
5 condenser.

1 6. The head driving apparatus as set forth in claim 5, wherein:

2 the constant-voltage circuit includes a Zener diode, a current limiting
3 resistance and a coupling element;

4 the Zener diode is electrically connected to the head driving power
5 source through the current limiting resistance; and

6 the Zener diode is electrically connected to the common electrode
7 through the coupling element.

1 7. The head driving apparatus as set forth in claim 6, wherein the
2 constant-voltage circuit includes a discharging diode electrically connected to
3 the head driving power source in parallel with the current limiting resistance,
4 such that a current is flowed to the head driving power source through the
5 discharging diode.

1 8. The head driving apparatus as set forth in claim 1, wherein the bias
2 power source includes:

3 a first condenser, electrically connected to the common electrode; and

4 a charger, which charges the first condenser with electric charges
5 discharged from the piezoelectric elements.

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1 9. The head driving apparatus as set forth in claim 8, wherein the charger
2 includes a second condenser charged with the electric charges.

1 10. The head driving apparatus as set forth in claim 9, wherein the charger
2 includes a constant-voltage circuit which regulates a charged voltage of the
3 second condenser, and applies the charged voltage to the first condenser.

1 11. The head driving apparatus as set forth in claim 9, wherein the second
2 condenser is charged before a printing operation is performed.

1 12. The head driving apparatus as set forth in claim 1, wherein:
2 the bias power source includes:
3 a condenser, which apply the bias voltage to the common
4 electrode; and
5 a charger, which charges the condenser based on a power
6 supplied from a power source for driving the print head; and
7 the bias voltage is substantially identical with an intermediate potential
8 of the drive signal.

1 13. The head driving apparatus as set forth in claim 12, wherein the
2 charger includes a switcher, which applies the intermediate potential to the
3 condenser when the drive signal is not used for ejecting the ink drop.

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1 14. The head driving apparatus as set forth in claim 13, wherein the
2 switcher is provided as a switching element.

1 15. The head driving apparatus as set forth in claim 13, wherein the
2 switcher is controlled in accordance with the drive signal.

1 16. The head driving apparatus as set forth in claim 1, wherein the bias
2 power source is provided as a reference voltage generator which applies a
3 reference voltage having a potential which is substantially identical with an
4 intermediate potential of the drive signal, to the common electrode.

1 17. The head driving apparatus as set forth in claim 16, further comprising
2 a charger which generates a charge signal for charging at least one of the
3 piezoelectric elements when the drive signal is not used for ejecting the ink
4 drop,

5 wherein the reference voltage generator includes:

6 a voltage holder, which latches an arbitrary potential of the drive
7 signal based on the charge signal; and

8 an current amplifier, which current-amplifies a voltage output from the
9 voltage holder.

1 18. The head driving apparatus as set forth in claim 16, wherein:

2 the reference voltage generator discharges at least one of the
3 piezoelectric elements when a potential of the drive signal is higher than the
4 intermediate potential while a printing operation is performed; and

5 the reference voltage generator charges at least one of the
6 piezoelectric elements when the potential of the drive signal is lower than the
7 intermediate potential while the printing operation is performed.

1 19. The head driving apparatus as set forth in claim 17, wherein the
2 reference voltage is applied when the charger charges the at least one of the
3 piezoelectric elements, based on the output voltage of the voltage holder.

1 20. The head driving apparatus as set forth in claim 18, wherein the
2 reference voltage generator includes a discharger which discharges at least
3 one of the piezoelectric elements.

1 21. A liquid jetting apparatus, comprising:
2 a jetting head, provided with a plurality of nozzles;
3 piezoelectric elements, each associated with one of the nozzles and
4 provided with a drive electrode and a common electrode; and
5 the head driving apparatus as set forth in any one of claims 1-20.

1 22. A method of driving a jetting head in a liquid jetting apparatus,
2 comprising the steps of:
3 providing a liquid jetting apparatus which comprises:
4 a jetting head, provided with a plurality of nozzles;
5 piezoelectric elements, each associated with one of the
6 nozzles and provided with a drive electrode and a common electrode; and
7 a head driver, which generates a drive signal for driving the

8 piezoelectric elements, and selectively supplies the drive signal to at least one
9 of the piezoelectric elements to eject an ink droplet from at least one
10 associated nozzle;

11 providing a bias power source in the liquid jetting apparatus; and

12 applying a bias voltage having a predetermined potential from the bias
13 power source to the common electrode of each piezoelectric element.

1 23. The head driving method as set forth in claim 22, further comprising
2 the step of charging at least one of piezoelectric elements when the drive
3 signal is not used for ejecting the ink drop.

1 24. The head driving method as set forth in claim 22, further comprising
2 the steps of:

3 determining a reference potential in the drive signal;

4 discharging at least one of the piezoelectric elements when a potential
5 of the drive signal is higher than the reference potential while a printing
6 operation is performed; and

7 charging at least one of the piezoelectric elements when the potential
8 of the drive signal is lower than the reference potential while the printing
9 operation is performed.

1 25. The head driving method as set forth in claim 22, further comprising
2 the step of varying a potential of the bias voltage so as to follow a potential of
3 the drive signal when the drive signal is not used for ejecting the ink drops.

- 1 26. The driving method as set forth in claim 22, further comprising the
2 steps of:
3 determining a reference potential as an intermediate potential of the
4 drive signal; and
5 adjusting the bias voltage based on the reference potential.

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